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Generation and Distribution of Power for Electric Railway Service in San Francisco.

Now that all of the street railway service of San Francisco, with the exception of the Geary Street cable line, is operated with electric power, a description of the power station equipment and distribution system of the United Railroads is of particular interest. Under present conditions, all of the power used is either generated in their own steam plants or comes from the system of the San Francisco Gas and Electric Company, which, in turn, is connected with the transmission lines of the California Gas and Electric Corporation. The new gas engine reserve plant, known as the Martin Station, will probably be available within a very short time, which will very materially increase the amount of electric power available for the operation of electric cars. The North Beach and Bryant Street plants of the United Railroads were not materially damaged by the fire, and at the present time are giving excellent service.

Early in 1902 the Market Street Railway Company, the San Francisco and San Mateo Railway Company, the Sutter Street Railway Company, and the Sutro Electric Railway Company, were consolidated into what is now known as the United Railroads of San Francisco. Soon after the reorganization it was evident that more power was necessary in order to give San Francisco a good street railway service, and the need of a new central station became imperative. At that time the power was derived from the following sources:

1. Bryant Street power house, consisting of four 1400 horsepower engines, direct connected to two 400 kilowatt Siemens and Halske generators; two 600 horsepower engines each belt connected to an M. P. 200 kilowatt generator, and two 300 horsepower engines each belted to an M. P. 200 kilowatt generator.

2. Carl Street power house consisting of a 250 horsepower and a 500 horsepower engine.

3. Oak Street and Broderick Street power house consisting of a 750 horsepower engine.

4. Sutro power house, which contains one direct connected 400 kilowatt and one direct connected 200 kilowatt generators.

5. Power house rented from the Pacific Power Company, having output of 600 kilowatts.

6. From the Independent Electric Light and Power Company, now the San Francisco Gas and Electric Company, about 1600 kilowatts.

It soon became apparent that the operation of many small plants was uneconomical, and that more power was needed in order to keep up with the growth of San Francisco. Thus plans were made for a new central power station and three sub-stations. The Bryant power station was still to be used, but the other plants were to be disposed of.

This new power station is located at North Beach. The alternating current is transmitted at 12,300 volts: 1st, to sub-station at Turk and Fillmore Streets; 2nd, to a sub-station at Geneva Avenue and San Jose Avenue; 3rd, to a sub-station at Milbrae. The Bryant Avenue station supplied all lines south of Market street to Thirteenth street.

The North Beach station is located at the corner of Beach and Buchanan Streets. Its dimensions are 113½ feet by 337 feet. It is located very near salt water, and condensing water is pumped from the bay about 400 feet from the power house. There is also a wharf close by where fuel oil and coal may be landed. The building is modern, the material used in its construction being concrete, brick, steel, iron and slate, making it fire-proof. The foundations are of the best material. The foundation of one engine is a solid block of concrete sixty-three feet long, twenty-four feet wide, and fifteen feet deep. The roof trusses are steel, and the roof is covered with slate. The chimney of brick was 152 feet high and 14⅔ feet inside diameter. The engine room is 48 feet by 287 feet, machine shop 48 by 45 feet, and the boiler room 58½ by 331 feet. Both engine and boiler rooms are 43 feet high from floor line to bottom of trusses.

There are four batteries of Babcock and Wilcox boilers, but four more batteries can be added in the future. Each battery has a capacity of 2500 horsepower, or total for all boilers is 10,000 horsepower. They are all oil burners, but provision has been made to burn coal when necessary.

The supply of oil is stored in a storage tank at a distance of 150 feet from power house. The tank dimensions are twenty-seven feet high, eighty feet in diameter, having capacity for 1,500,000 gallons. The oil is pumped directly from oil barges at the wharf through a five inch pipe line.

The main storage tank is connected by independent 5-inch pipes and blow pumps to two auxiliary feed tanks, each of 20,000 gallons capacity. Each tank is connected independently to each furnace. All tanks are equipped with heating cribs, and when necessary exhaust steam may be used to heat the fuel oil.

Water is supplied by mains from the Spring Valley Water Company. The water from the surface condensers is filtered and used again. This filter consists of a number of felt strainers which catch the oil and scum One strainer may be taken out of the filter at a time, cleaned, etc., without interfering with the process of straining.

The plant was originally designed for four engines, two of which are now in operation. They are the vertical marine type, built by the Union Iron Works, and are triple expansion with 32-inch, 52-inch and 80-inch cylinders with 42-inch stroke, built for a working pressure of 200 pounds, at a speed of 136 revolutions per minute. Their normal capacity is 4080 horsepower each, with a capacity for 25 per cent. overload. Thus when the four engines have been installed there will be an aggregate of 20,000 horsepower. These engines are the largest stationary steam engines that have ever been built or used on the Pacific Coast.

The condensers are the marine type surface condensers, having 3034 tubes three-quarters of an inch in diameter, having cooling surface of 7200 square feet. It is also arranged that they can be used as jet condensers. The air pump has a thirty-four inch cylinder and a twelve inch stroke. The water for condensers is pumped from the bay through two 32-inch pipe lines. The pump is electrically driven.

Each engine is direct connected to two 20 pole 1200 kilowatt, 136 revolutions per minute, 13,200 volts, 25 cycle, three phase General Electric revolving field generators; the fields being excited by an M. P. six pole 100 kilowatt 500 revolutions per minute, 125 volt exciter, driven by a six

pole, 150 horsepower, 500 revolutions per minute, 350 volt induction motor when under light load. Under full load the field is excited by an M. P. eight pole 200 kilowatt 500 revolutions per minute 125 volt exciter, driven by a six pole 300 horsepower 500 revolutions per minute, 350 volt induction motor. The fields are excited on starting by a six pole, seventy-five kilowatt, 250 revolutions per minute, 125 volt exciter, driven by an engine. For the induction motors driving the exciters and blowers there are two air blast transformers. They are three phase, twenty-five cycle, 150 kilowatt and 300 kilowatt, and transform down from 13,200 volts to 370 volts, and are air cooled. The two motors driving the fans are four pole type, two horsepower, 750 revolutions per minute, 350 volt induction motors.

There are eight General Electric oil switches, which are controlled by motors, four being connected to the generators, two to the outgoing lines, and two to the exciter panels. The switchboard consists of four generator panels, one exciter feed panel controlling the four generators, two blower motor starting panels, and two induction motor panels. All electrical equipment was made by the General Electric Company. There is also installed a traveling crane of thirty tons capacity.

The line is run from the North Beach power house to Fillmore Street and Turk Street. The poles are of redwood 16 inches by 16 inches at base and 10 inches by 10 inches at top. They are set in concrete, having been treated with crude oil. The cross arms are of Oregon pine, 4 inches by 6 inches by 5 feet 5 inches, and one 4 inches by 6 inches by 7 feet 5 inches.

From the main station there are two circuits each of three No. 000 solid, triple braided, water-proof wire. The wires are arranged as follows: Each circuit on one side of the pole, one wire on the top cross arm, and two on lower cross arm.

Iron pins with porcelain bases are used. The insulators used are the Locke No. 100 broom porcelain, having been tested for 50,000 volts.

The Turk and Fillmore sub-station is 45 by 109 feet, and is entirely fireproof. It is equipped with six rotary converters, each being a ten pole, 750 kilowatt, 300 revolutions per minute, 600 volt on D. C. side, and compound wound.

There are eighteen transformers, twenty-five cycles, ratio of transformation is 13,200 to 440 and are air cooled. There are three blower motor sets each consisting of 1-four pole, five horsepower, 750 revolutions per minute 350 volts induction motor. The blowers are fifty-one inches in diameter.

There are ten motor controlled oil switches. The number of A. C. panels on the switchboard is 10—two panels for in-coming line, two for out-going, and six for A. C. side of rotaries.

The rotaries are started from the A. C. sides in the following manner: First the oil switch is closed. The transformers are so wound that there is transformation from 3 phase Delta to 6 phase Delta.

In starting then the fields of the rotary are open, so as to get rid of the danger of puncturing insulation of the fields by the high induced voltage.

The rotary starts up as an hysterisis motor, the A. C. current in armature inducing eddy currents on pole pieces. The positive brush from the D. C. side is brought to the side of the machine, and also the positive bus bar or equalizer and the above two leads are here connected. The use of the bus bar is as follows: If for some reason one machine should be generating a lower voltage than the other, the higher voltage machine would start to take load while the other would decrease in load. This difference of potential, however, could not be very different on account of the constant A. C. voltage. Still it is very desirous that both machines take an equal load. Thus by bringing the equalizer bar to the positive terminals current would flow from higher potential machine to the lower potential machine around through the compound field and thus raising its voltage, and thus making it take its share of the load. In each A. C. panel of the rotary there is a power factor indicator, and it is very desirable to keep this about unity. This is done by varying the shunt field. On each A. C. rotary there is a resistance box connected in parallel with the compound field and by varying this resistance the amount of compounding can be changed. By varying the shunt field resistance, which is done by a hand regulator on each A. C. rotary panel, we can get practically unity power factor.

The switchboard is as follows: Taking first the front view there are ten A. C. panels and twenty-six D. C. feeder panels, and six rotary panels feeding to the bus bar. Starting from the left there are, 1st, four high tension panels, the first two being the out-going lines, each panel having three ammeters, one for each leg. The next two panels are for the in-coming lines, each having one ammeter. The next six panels are for the primary side of the transformers of each machine. Each panel has a power factor indicator, an ammeter and voltmeter whose constant is 120. From these instruments we are able to get the input for each machine and transformer. All of the above panels for the machines have a hand regulating resistance box. The resistance itself is beneath the floor and is operated by a chain running to the switchboard. On each of these ten A. C. panels there is a switch for operating a motor which controls the oil switches. Above and below this motor control switch are lights, the red light being above; the green light below. When the red light is burning it signifies that the oil switch is closed, and when the green light is burning it signifies that switch is open. The control motor is placed upon the casing of the oil switch.

The next six panels are for the D. C. side of the rotaries and each panel is equipped with the following: A circuit breaker, an ammeter, also receptacle for voltmeter plug, the voltmeter being placed a little to the left of the switchboard. Then there is the knife blade switch for throwing rotary onto the bus bar, and below this is an integrating wattmeter. The ammeter does not carry the whole line current but is shunted across a small portion of the line. Each of these ammeters have a scale running up to 3000, the smallest division being 100 amperes.

Then the next twenty-six panels are for the feeder lines. Each of these panels have a circuit breaker, an ammeter, and a single pole, single throw switch. The ammeters have a capacity of 100 amperes.

Directly beneath the transformers is the air blast room. The blowers force the air into this chamber and the only exit is out through the transformers, part going out the side and part out the top of the transformers.

NOVEL SUGGESTION FROM BERKELEY.

Ex-Secretary of the Treasury Charles Stebbins Fairchild, informed the Berkeley College Commerce Club recently in an informal address, that the only action he could suggest to stop the concentration of power in the hands of a limited number of financiers is to stop the use of steam and electricity. "In my opinion," said Mr. Fairchild, who was in Cleveland's first Cabinet, and who is a banker of renown, "the so-called concentration of power in the industrial and financial world today is due almost entirely to the improvements in transportation methods. The foundation of these improvements are the use of electrictiy and steam. If we want to do away with concentration, then I am afraid we will have to dispense with electricity and steam."

James W. Warren, general superintendent of the Los Angeles Gas and Electric Company, has resigned and severed his connections with the company with which he has been connected during the last twenty-five years.

Street Railway in Manila.

Electric railway construction, both street and interurban, has become so standardized in this country that only in exceptional cases do questions on engineering arise to attract the engineering world in general. Here, in the United States, news of the construction, or of the proposed construction, of a new electric railway is valuable generally only as a news item for the reason that the problems that must be met by the contractors are, in the great majority of cases, but little different from the general run of those which it has been necessary to solve in placing electric traction on its present footing.

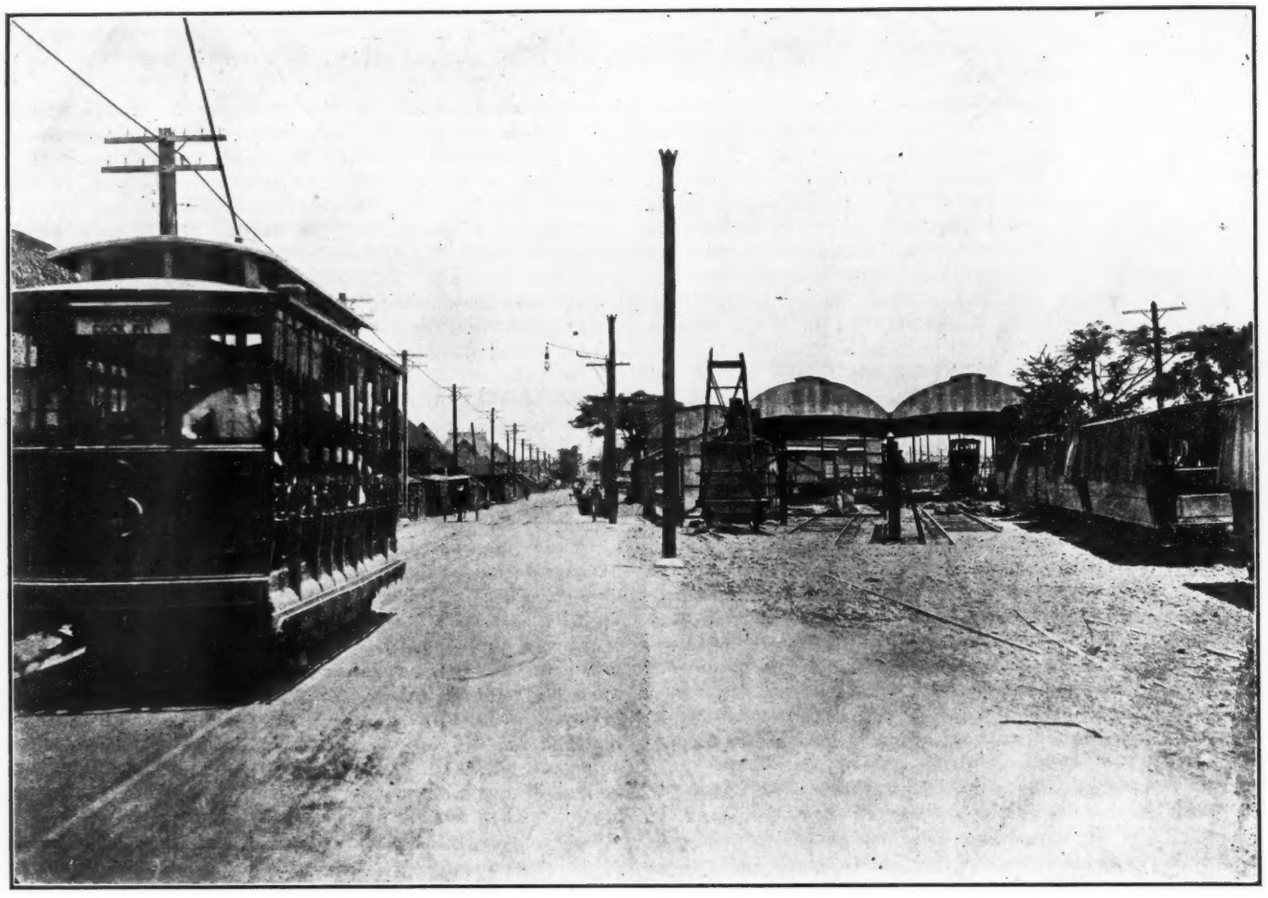
The change of field, from the United States to the far East, entirely alters the whole aspect of this branch of engineering enterprise and introduces new difficulties of broad interest to the technical world simply because they are indicative of the requirements which will be imposed upon engineers who will be engaged in the future in ever increasing numbers in exploiting this territory. The advancement of the project, entirely modern in character, but situated in a land at best only partly civilized, where no certain dependence can be placed upon native assistance in the undertaking, requires business and engineering attainments of the best and abundance of resources coupled with a considerable knowledge of the character of the inhabitants in the country to be developed.

Somewhat over three years ago the initial important invasion by American financial interests in the Philippine Islands was projected.

This enterprise took definite form in the purpose to renovate the traction and lighting properties of the City of Manila. The problem, in brief, consisted in re-building all of the track of the old horse tram, of which the rails were only of such weight as was necessary for rolling stock of a diminutive nature. A modern electric power house of large capacity had to be built to operate the railway and a subsidiary project consisting in the re-habilitation of the existing electric light company's service required the devotion of a portion of the output of the new power house to lighting purposes. The original electric light company, known as "La Electricista," owned only an old and out-of-date power plant, so the problem which had to be undertaken comprised the supplying of the city of Manila with a complee modern public lighting system.

The value of an extensive modern traction system to Manila could hardly be over-valued. The city is one of great distances, and it has been one of the problems of life there to move between points widely separated without complete consumption of one's time. There were but fourteen miles of the old horse drawn tramway and that, of course, was intolerably slow.

While not as pressing as the need for a modern transportation system, the improvement effected by the Manila Electric Railway and Light Corporation of the lighting system of the city has been of great benefit. Formerly, the company "La Electricista" controlled this business. The original company, owned and operated by Spanish residents, managed to give fair service despite adverse conditions. The great difficulty lay in the inadequacy of station and distributing system for the demand. The power plant of "La Electricista" was a heterogeneous collection of boilers, engines, and rope, driven and direct connected generators, alternating and direct current. It was a typical example of piece meal addition to meet a growing demand to perform its functions



TONDO BARNS, MANILA.

with general satisfaction to customers within the limit of its capacity.

At the very inception of the undertaking the paramount question was as to whether Filipino labor could be succesfully employed. In earlier situation of the management of the native labor, it was found that the natives either would not work at all, or worked only upon prepayment for the day's labor. Then began the arduous task of utilizing the rawest of raw labor in the use of our own tools, such as the shovel, crowbar, pick, axe, wheelbarrow, etc. It was necessary to inculcate a conception of their uses; even so rudimentary a tool as the shovel had played no part in the natives' ways and means of handling material. To squat and remove material with the hands, or to stand and displace it with the feet, were methods at first generally preferred as standard practice. When the foreman turned his back the shovel would be quickly discarded for the return to the primitive method. The wheelbarrow had before played no part in the native system of transportation and the natural idea at first entertained was that the barrow was simply a receptacle to be filled and carried either on the head or on the shoulders.

Gravel for filling in the side of the power house was obtained from the bed of the Pasig River above the city. The natives began operations by loading their frail canoes with their hands and feet, unloading with small basket, filling in the same way, and carried to the point of distribution upon the shoulders. In only one way did this idiosyncrasy serve to expedite the work of installation. By virtue of his natural agility and ability to climb, the average native could ascend trolley poles for stringing wires far more readily than an American lineman with spikes.

As carpenters, the Filipinos are well nigh unbeatable on rough work, using, though he does, little or nothing but his machete. Their natural ability as artisans was quickly demonstrated too, when the time for the erection of the steel work arrived. Essentials of efficient riveting were quickly absorbed with other details of steel work. This aptitude was, of course, manifestation of the capacity for imitation held in common by nearly all Oriental people. The success with the native workmen in the mechanical trades has led to the adoption of plans to build all car bodies in the shops, employing a rank and file of native workmen with a few white foremen

Aside from the question of labor, numerous physical difficulties have presented themselves in the installation of the new system. The depredations of the torredo, or white ant, are so great as to limit the builder in his selection of woods to two or three expensive varieties which are invulnerable to its attacks. Australian hard wood, Jarrah, and the native Filipino wood, Molave, give the best satisfaction.

Steel work also is subject to peculiar trying physical conidtions in Manila. Corrosion is about twice as rapid as in the United States because of the extreme humidity and a special compound carbon paint was used on structural steel work in the power plant and car shops, while all steel work exposed to the direct action of the elements, such as rails, was painted with asphaltum.

The power house is a steel and concrete building situated upon an island in the Pasig river virtually central as regards distributing territory. The river is a medium for the direct supply of fuel which is imported from Japan and Australia, and provides also the necessary condensing water.

The foundations of the building consist of two and one-half feet of concrete mortar resting upon piles driven twenty feet to a sub-stratum of hard sand. The surface soil formation is too soft to afford suitable foundation. The same method of securing foundation by piles driven to the

sub-stratum is used for engines, boilers, and all heavy machinery.

The general dimensions of the main building are 101 feet by 170 feet by 37 feet high, the basement occupying twelve feet of the height. The engine room and boiler room lie parallel, the former being forty-seven feet wide and the latter fifty-four feet wide. Both boiler and engine room is so arranged structurally as to admit of enlargement in the future symetrically at both ends. In view that it may possibly become advisable to install a force draft system, air blast ducts are provided for all the boilers. Feed water is obtained from driven wells and is raised by means of compressed air to a stand pipe in the boiler house. Condensed steam is delivered from a hot well to a reservoir located in the boiler room immediately in front of the stack where it joins the make up feed water taken from the stand pipe. From the reservoir boiler feed water is fed by gravity through heaters to the feed pump suction The boilers are provided with Metropolitan double tube injectors. The feed water heaters have a daily capacity of 1500 horsepower.

The frame is structural steel consisting of columns, roof trusses and purline. The walls are of pored concrete and the roof and floor of concrete slabs. The solid wall structure, however, extends only to within twelve feet of the ground, the climate demands open construction below that for purposes of ventilation. The windows are set in steel frames, the sashes being made of native hard wood. The basement floor of the engine room is situated in the same level as the floor of the boiler room and contains most of the auxilliary machinery and the main steam leads. The generators are all located on the main floor of the engine room, together with the switchboards.

There are eight Babcock and Wilcox boilers of 400 horsepower each, arranged in two batteries of equal size on either side of the self-supporting steel stack, which is 175 feet high. There is a line of fire brick the entire length of the stack and there are two nozzles near the base to which the smoke flues are connected. Steam is generated at 200 pounds pressure with a superheat of 600 degrees. At the present time the boilers are hand fired and have flat grates but provision has been made for the installation of stokers should it ever be considered advisable.

The principal coal handling device is a large radial Jantry crane with a capacity of fifty tons per hour. This crane unloads directly from the holds of lighters and deposits the fuel in open air storge or directly to the boiler room.

The engine room contains at the present time three 750 kilowatt Westinghouse-Parsons turbo-generators, and one 1500 kilowatt Westinghouse-Parsons machine. The former are designed for a speed of 1800 revolutions per minute on the pressure of 200 pounds per square inch and twenty-seven inch vacuum. The output is alternating current generated at 370 volts and sixty cycles. Condensing water is circulated through the main heater which distributes to the condensers by fifteen double suction centrifugal pumps, each direct connected to a Westinghouse engine and having capacity of 7000 gallons per minute. The intake is through a concrete conduit three feet by eleven feet from the Pasig River on one side of the island and the discharge is through a tunnel built from the power house to the opposite side of the island. There are three 500 kilowatt rotary converters, 370-600 volts, one 300 kilowatt rotary, 370-600 volts, and one 125 kilowatt Booster direct connected to one of the above rotaries. The exciting units consists in one fifty kilowatt motor driven machine and two thirty-seven and one-half kilowatt steam driven machines. The transformer installation is four units—250 kilowatt 360-3400 volts and two 500 kilowatt 360-3400 volt units.

The streets of Manila are paved in various ways and it has been necessary to a certain extent to accommodate the track to the pavement in which it was laid. In macadam, of which there is a great deal, seventy pound A. S. C. E. section tee rail was laid, while in the paved streets where block granite and hardwood block was met with, a ninety-four pound girder rail was employed. The tee rail is laid on ties twenty-four inch centers with special angle board joints, Harvey trip track bolts, in the lag screw spike instead of a standard spike. This spike has been employed extensively in Europe and it necessitates boring the tie before the spike can be screwed in. It has proven a great success. After the series of experiments previously noted, the Australian hard wood, Jarrah, which resembles teak, was generally adopted for the ties. The native wood, Molave, was used in such quantities as it could be secured.

The rolling stock consists in medium weight cars in no way departing from standard practice for the variety of service. Owing to the tropical climate, however, the entire stock consists of open cars. The firm of J. G. White and Company of New York were the engineers.

HEALTHY GROWTH OF ELECTRICITY IN PERU AND BRAZIL.

That there is a healthy growth in the installation of electrical machinery in the southern continent is well shown by several activities in Peru and Brazil. The Empresa Electrica de Santa Rosa, Peru, which already operates a large generating station on the River Rimac is extending its service to such a degree that an additional power house is necessary. This will be operated in parallel with the present station. The equipment for the new station includes two General Electric three phase, sixty cycle, revolving field, alternating current generators, each having a capacity of 1200 kilowatts and operating at 2300 volts. The generator voltage will be stepped up in three 750 kilowatt, water cooled transformers to 33,500 volts, and transmitted to a sub-station where distribution will be made from water-cooled step down transformers at 2300 volts. The electrical equipment, including generators, transformers, switchboards and auxilliary apparatus has been ordered from the General Electric Company.

In Brazil the Sao Paulo Tramway Light and Power Company is also making additions to its present equipment. At the generating station another General Electric three-phase, revolving field, 2000 kilowatt, 2300 volt generator is about to be installed with necessary switchboards for the operation of the new machine. In addition the equipment will be increased by three General Electric sixty cycle, 666 kilowatt, 2,4000-2000 volt transformers and three sixty cycle, 666 kilowatt, 20,000-2300 volt transformers of the same type. This power house furnishes current for the electrical triumvirate railway, light and power and the railway equipment is being increased by ten double motor GE-58 car equipments, and one GE-28 four motor equipment.

Another interesting installation about to be made in Peru is at the mines of the Inca Mining Company. The location of the properties of this concern makes transportation very difficult, and all material has to be packed up the mountain trails on mules. The electrical equipment includes a General Electric three phase, 200 kilowatt, 6600 volt alternating current generator of the revolving field type. In addition there will be four sixty-seven kilowatt transformers as well as several induction motors for hoisting work and the necessary switchboards. The complete equipment will be furnished by the General Electric Company. In oder to facilitate transportation all the apparatus will be constructed in parts, none of which will weigh over 350 pounds, except the alternator shaft. The work of assembling the machinery will be done at the mines.

Mr. F. H. Poss, with the Benjamin Electric Manufacturing Company, New York, has established his office and sample rooms at 157 Minna street, near Third street.

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EDITORIAL

Water Power Transmission Systems in Connection with City Service

The demand for electrical energy in large cities has increased to such enormous figures that notwithstanding the use of electricity for manufacturing purposes, at what might be called manufacturing centers, and for interurban electric railways, by far the largest amount of electrical power used at the present time is applied to city service in some form.

The electrical energy so used is required for three different kinds of service, each more or less distinct and different in kind from the other. The first probably requires the greatest amount, and includes all kinds of transportation service, such as electric railways and office building elevators, all of which service for the most part requires direct current. The second character of service is for manufacturing purposes, and is in general in the form of alternating current. The third character of service is for electric lighting and is confined very largely to the hours between 6 p. m. and 6 a. m., varying materially with the season of the year. With the introduction of alternating current lamps for street illumination, this character of service has been converted to alternating current almost exclusively.

In any power system, whether from water power or steam generation, the load factor or variation of load during each 24-hour period is of the greatest importance in connection with economical operation. From the power station standpoint, electric lighting for domestic and business purposes is distinctly undesirable. Street illumination is to be preferred, as all-night service assists in producing a high load factor. Power for manufacturing purposes is confined almost entirely to the daylight hours. The same may be said of elevator service, which is, naturally, of such small importance as not to affect the load factor materially one way or the other. Electric street railways, however, without a storage battery auxiliary, produces necessarily an exceedingly variable load. Not only is this true during each day, but there are certain times, such as holidays and festival occasions where the maximum demand for street railway service is abnormal. At such times a large portion of the inhabitants are depending upon the street railway system, and failure of service or lack of sufficient transportation facilities is exceedingly disastrous financially and otherwise to the operating company.

The ideal water power transmission system is one where the same amount of power is generated at all times The use of a large reservoir at the head of the pipe line gives an additional peak load capacity, but in such cases reserve or spare machinery is usually required to generate the power necessary.

Interruption of service must at all hazards be prevented in any of the three power requirements indicated above. Even for the shortest periods a shut down results in the most serious consequences. Auxiliary power plants are, therefore, practically indispensable where water power transmission service is utilized in cities. For greatest economy, such an auxiliary plant should take up, in a large part, all of the variations in load. This should be done, if possible, by using just the proper number of units at each time, rather than operating units at fractional load.

Good regulation of voltage is quite necessary for electric lighting purposes. Excessive variations are to be avoided, of course, in the other two classes of service, but for the purposes of general illumination, it may be said that the regulation at the receiving end of any long distance transmission line, without an auxiliary plant, running in parallel with the transmission system and taking up the variations of load, would not be tolerated in any large city electric lighting system. The electrical transmission of energy is so flexible that it is with considerable ease that an auxiliary plant, either with or without a storage battery, will produce the best of regulation for the entire distribution system.

Finally, the element of cost of electric power at the switchboard will always enter materially into the problem of deciding whether or not transmitted electrical power is to be extensively used for city service. It is manifestly unfair to eliminate the cost of operating an auxiliary plant in estimating the cost of transmitted power delivered to the switchboard. Considering the transmission system alone and accepting the character of service which can be depended upon from such a system, which may include wide variations in voltage, as well as frequent interruptions of service, the cost per kilowatt hour may be figured remarkably low. When there is included, however, the costs connected with the operation of the auxiliary plant which insures good regulation and continuous service, the cost per kilowatt hour may not be materially less than if the power were generated from fuel directly at the point of consumption. The combination resulting from the continuous use of a fixed amount of transmitted power, allowing the auxiliary plant to carry only variations in the load which naturally occur in city power service, should in most instances give not only the most economical production of power, but the most satisfactory service in every respect.

CALIFORNIA AND ITS GROWTH.

According to the statement issued by the two railroads doing business in this State 25,000 people took advantage of the colonist rate, which was put into effect in the middle of February and lasted until the first week of April, to come West and here select their future homes. Fifty per cent of the travelers stayed here and purchased small farms with the intention of going into the business of raising fruit for the market.

This means that about 12,500 people settled in the State, which is a good showing for the time the rate was in operation. We are further told that some of the colonists went as far north as Klamath County, in Oregon, and there settled. Probably there is no spot on the Coast which will at some future date support so prosperous a community as the country around Linkville; and the reason is that there is plenty of power there, and that there are now on foot plans to develop a number of industries in a section which fifteen years ago was given over to the jack-rabbit and a few cattle growers.

The truth is that very few people realize the enormous growth of the State, and though there are some who presist in decrying the State and saying that this is no place for the poor man, yet the poor man is coming into California with the intention of making his living here. In plain words, this State is the paradise for the poor man, despite all that may be said to the contrary. There is no other country in the world which affords so many opportunities to the poor man for making a living as California.

Men are needed in the State. The Santa Fe road sent all through the middle west to secure labor, and the Ocean Shore line and the Western Pacific are hiring all the men they can get. The wages that are given laborers here are much higher than that obtained in the East. There is work for thousands of men all along the Pacific Slope. It is estimated that over one hundred millions of dollars will be spent in the next two years on railroad work alone in the states of Oregon and Washington and the burning question of the hour is that of labor. In this State we are building a great transcontinental highway where skilled labor is needed, not to speak of other railroad work that shortly will be undertaken.

In fact the conditions in the West are rapidly changing. A few years ago it was thought that if a man came to the Pacific Coast all the work he could find, or would find, would be to slave on a dairy rancho or hoe the land on a fruit farm. This is not the case now.

The man who has a good mechanical training will find that employment awaits him. There is growth all along this line. It is the day for the master mechanic, and the West is the one spot on the face of the globe which will give him a good living and under the best conditions.

Men who are supposed to speak with authority say that we are on the eve of a boom the like of which has never before been witnessed in any part of the world. This may be so, or may not be so, and we would advise people to accept with a good many grains of caution all the reports that are being daily published as to the formation of new companies. The rich strikes in the gold fields of Nevada has promoted a spirit perhaps of reckless enthusiasm and there are companies being floated which will perhaps never reach the fullness of maturity; but these are only on the surface, and the man who has good common sense can easily distinguish between the bona fide company and the one that is promoted for purely speculative purposes.

One thing we can assure our readers, the boom in this State and in the adjoining states is no wildcat boom. It is a healthy and a long-lived boom; and it behooves the man who has an in interest in the West to help this condition along by not neglecting the opportunities that are daily hurled at him. There is a trite saying which will be forgiven if repeated here: "It is time to get in the band wagon and ride."

THE ILLUMINATING ENGINEERING SOCIETY.

A new engineering society devoted exclusively to matters relating to illumination has been formed in New York City. President L. B. Marks, who from the beginning has been an authority upon electric illumination, made the inaugural address, which is of great value to those interested in the general subject of illumination. His address in part is as follows:

PRESENT STATE OF THE SCIENCE AND ART OF ILLUMINATION.

Applying the term illumination to the use, in contra-distinction to the production of light, it may be truly said that while great strides have been made in recent years in the development of almost every detail concerned with the production of light, illumination, particularly from an economical standpoint, has been sadly neglected.

Broadly speaking, the electrical engineer has concerned himself with improving the efficiency of the generating apparatus and cutting down losses in the transmission of power, but after his wires have reached the point at which the electric current is to be transformed into light, his engineering skill has not, as a rule, been applied. Similarly, the gas engineer has been busy with questions involved in the manufacture and distribution of gas, while the problem of obtaining the maximum value or most effective use of the illumination delivered at the burners has been relegatd to a secondary position.

So far as interior illumination is concerned, the lighting layout has been left largely to the architect. It is he who usually prescribes the number and location of outlets for the light sources, specifies the number and candle-power of the lamps and designs or select the lighting fixtures and accessories. Very often these specifications are completed before the color-scheme of the interior has been decided upon, with the result that the degree of illumination obtained may fall far short of what is needed in cases of dark colored interiors, or be excessive in the case of light tinted rooms.

The natural tendency of the architect is to make the economical side of illumination subservient to the aesthetic, while on the other hand the tendency of the engineer is to consider only the quesion of economy. It is an encouraging sign of the times that the architect and the engineer are gradually drawing closer together in dealing with problems involving both the scientific and the artistic side of illumination.

Though much attention has recently been given to the subject of globes, shades and reflectors, the fact still remains that unshaded or inadequately shaded lamps are the rule rather than the exception. In considering the present status of the science and art of illumination, there is perhaps no question that is in need of more immediate attention than this one. The practice of placing lights of excessive intrinsic brightness within the ordinary field of vision is so common as to cause grave apprehension among those who have studied the question from a physiological point of view, that our eyesight is suffering permanent injury. That the percentage of children with defective eyesight is growing year by year, is a well-known fact. According to oculists, the strain on the eye caused by bright lights is in a large measure responsible for this condition. Those who have been subjected to the painful glare of the bare lamps used for illuminating our electric cars, will attest to the visual discomfort caused by the subjection of the eye to an unshielded source of light even as small as a 16 candlepower lamp.

Much of the trouble due to this cause would be removed if the light sources were screened or concealed, and the illuminating power from them derived from reflected rather than from direct rays. Happily the tendency of modern illumination is in this direction.

From an economical standpoint the correct disposition of the light sources and the use of the most suitable reflectors, are of commanding importance. It is not uncommon to

find instances in which adequate consideration of these two questions would result in largely increasing, and often more than doubling, the useful illumination, without increasing the cost.

Both electric and gas supply companies are alert to this situation and are now giving these questions more serious consideration than ever before. The far-sighted manager of the supply company sees that it is to his ultimate advantage to assist the consumer in obtaining the very best illumination of his premises at the least expenditure of money for electricity or gas. In view of the above, it is extremely desirable that complete and authoritative data be obtained as to the amount and character of illumination best suited for individual conditions. At the present time there is a lack of really valuable up-to-date information on this subject, at least so far as published records go; moreover, much of the information that is available is widely scattered and often inaccessible.

The performance of lamps for street lighting and illumination of large open spaces has not been adequately recorded in papers bearing on this phase of the science of illumination. In view of the lack of complete data on this subject, there is a wide difference of opinion to-day as to which of several illuminants is best suited for certain cases of street and country road lighting, illumination and economy both being considered.

The progress of invention in lamps and lighting apparatus has been so rapid that engineers have found it difficult to keep abreast of the times in the question of illumination. Only a comparatively few years ago the carbon filament incandescent electric lamp, the arc lamp (open or enclosed) and the ordinary gas flame were the only illuminants with which we had to deal. To-day we have besides these among electric lamps, the incandescent lamp of the Nernst type, the tantalum lamp, the mercury arc of the Cooper-Hewitt type, the vacuum tube lamp of the Moore type, the impregnated carbon and the magnetite or "flame" arcs, and others; and among the gas and oil lamps, the mantle burner lamps of the Welsbach and allied types, the oil lamps with forced air draught, the acetylene flame and several others.

The amount of light and especially of electric light used in the United States has grown by leaps and bounds. The consumption of gas for illuminating purposes has also largely increased, the introduction of the mantle burner having given a great stimulus to the gas lighting industry. The place of the acetylene light has been firmly established, and the extended introduction of acetylene plants in the past few years is worthy of special note. The approximate amount of money spent by the consumer for illumination by the electric light, gas and oil in the United States for the year 1905 is as follows:

Electric light	Between	$100,000,000.	and	$120,000,000.
Coal and water gas	"	35,000,000.	"	40,000,000.
Natural gas	"	1,700,000.	"	
Acetylene	"	2,500,000.	"	3,000,000.
Oil	"	60,000,000.	"	

At a conservative estimate the consumer is spending a total of over $200,000,000 a year for lighting by electricity, gas and oil, in the United States. Of this amount I venture to say that he wastes fully $20,000,000 by reason of his failure to properly utilize the energy supplied. No one who has made a study of the subject can fail to see glaring examples of this waste at every hand. It is not at all uncommon to find in electric lighting that twenty-five per cent. of the light furnished is lost so far as any useful purpose is served, through improper disposition of the light sources or unsuitable equipment of lamps, globes, shades or reflectors. In gas lighting though the conditions are quite different, the same criticism in a measure holds true.

AIMS AND OBJECTS OF THE SOCIETY.

It is one of the aims of this Society to assist in remedying the conditions just referred to; to point out in what way the best illuminating result may be obtained from any source of light, be it electric, gas, oil, or candle. With this object in view the theoretical and the practical side of lighting will be given full consideration and the aesthetics of the question studied alongside of the economics. The society will aim to gather into its fold the various interests that are identified with the development of the science and art of illumination in all its phases. The specialist in illumination, the electrical engineer, the gas engineer, the architect, the designer of electric and gas fixtures, and of globes, shades and reflectors, and the decorator,—all will meet on common ground to discuss the question of illumination from every standpoint. The views not only of the engineer but of the practician will be courted. The keynote of the organization will be co operation in all that makes for the good of the cause.

The Society will undertake to gather authoritative data on the subject of illumination and render it readily accessible to those interested. It will hold monthly meetings during the year 1906, except in the months of July, August and September. At these meetings papers dealing with all sides of the question of lighting will be read and discussed. These papers and the discussions thereon, together with reports of Special Committees and data collected, will be published.

SCOPE OF THE SOCIETY.

The term "Engineering" as used in the name of this Society, unless viewed in its broad sense, is to a certain extent a misnomer, as the Society will deal with some phases of illumination that may not properly be said to come within the distinct field of engineering, such for instance, as the physiological side of the question. The Society will be interested in every phase of the subject of illumination whether from an engineering point of view or otherwise, and will throw its doors quite as wide open to the layman as to the professional. It will not, however, deal with questions relating to the production or distribution of the energy from which the light is produced.

The question of candle power rating and of nomenclature will receive the attention of the Society. At the present time it must be confessed that the rating of lamps often leads to a great deal of confusion. Some lamps are rated on the basis of horizontal candle power; some according to the downward candle power, and some according to other standards. The Society will endeavor to assist in bringing about a uniformity of candle power ratings and the general acceptance of definite nomenclature.

From what has proceeded it will be seen that the scope of the work to be performed by the Society is broad. The Committee on Papers has suggested a number of subjects upon which papers will be written for presentation before the Society. Among these are principles of interior illumination with special reference to cost, color of light and physiological effects; street lighting; illumination data; lighting with special reference to ventilation; lighting with special reference to distribution; illumination from the architect's standpoint; aesthetics vs. utilitarianism in the design of fixtures, globes, shades, and reflectors; the "flame" or luminous arc; inverted gas mantle burner; vacuum tube lighting; oil burners; acetylene lamps; new illuminants; candle power rating of illuminants. One feature of the work of the Society will be the consideration of special cases of lighting as for instance, the proper illumination of the assembly hall or auditorium, of the library, of the picture gallery, of the drawing room, of the factory, of the store, of the show window. The degree of illumination best suited to the individual conditions will form the basis of an investigation to be made at the instance of the Society. Besides the subjects mentioned above there are many others which need not be enumerated here that come within the scope of the society.

Trade Catalogues.

The accompanying illustrations show the details of the small polyphase induction motors from one to seven and one-half horsepower, made by the Stanley G.-I. Electric Manufacturing Company.

Figure 1 is a side view of the motor showing the exposed laminations. This construction allows the laminations to

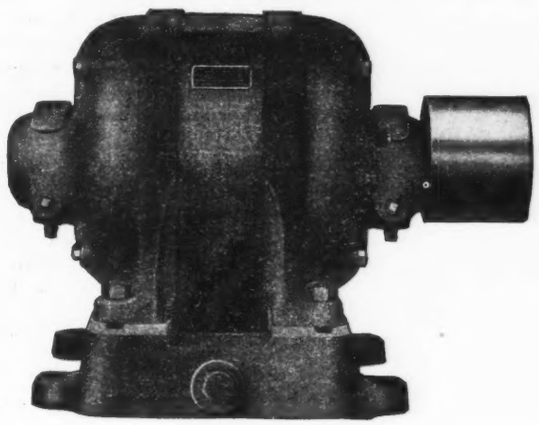


FIG. 1.

be freely exposed to the air so that the heat is radiated without any obstruction.

Figure 2 shows a three horsepower motor disassembled. The small number of parts and ease with which the motor

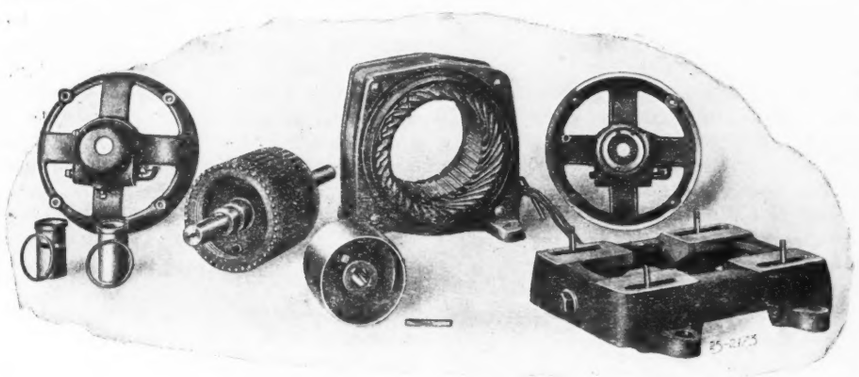


FIG. 2.

may be put together is of decided importance in its construction.

Figure 3 shows the relative size of the new two horsepower polyphase motor and the old Stanley motor of the same capacity built fifteen years ago.

The improvement in mechanical and electrical construction is strikingly illustrated, the new and smaller motor excelling the old type in point of efficiency and general perfection notwithstanding its decreased weight.

Bulletin No. 1051 of the electrical department of the Allis-Chalmers Company illustrates various types of belted alternators. The details of the field rotor, field coils, collecting rings and brushes and also bearings shows the excellent construction of these alternators. The machines are built for voltages of 1100, 2200, 4400, 6600 and 13,200, but for special cases may be wound for low voltages as 440 or 550 where the current is to be used at the point of generation. These belted alternators, which are known as type A. H., are built in the following sizes: For two to three phase, sixty cycles, from 50 to 800 kilowatts; for sixty cycles, single phase, from 37½ to 300 kilowatts; for twenty-five cycles, two to three phase, 85 to 1000 kilowatts.

Book Reviews.

"The Copper Gossip," issued by the National Conduit and Cable Company, contains interesting news regarding the copper situation. The number of June 20th shows that the exports of copper for the United States for the first five months of 1906 was 83,131 tons as compared with 107,705 tons for 1905. The imports of copper for the same period of 1906 were 41,420 tons and for the same five months of 1905 were 36,300 tons. In each case a ton being equivalent to 2240 pounds.

A forty-eight page pamphlet describing various types of horizontal and vertical ammonia compression refrigerating machines and equipment for ice plants, breweries, packing houses, etc., has just been issued by the De La Vergne Machine Company, foot of East 138th street, New York. The book is illustrated by many fine halftones, a feature of these being the clever and artistic arrangement of composite views of plants installed in various parts of the world.

EARNINGS OF ELECTRIC RAILWAYS.

The gross receipts for the year 1905 of the electric street railway companies in America is completely set forth in the Red Book for 1906, of the "American Street Railway Investments." These statistics include the operating reports for 1905 of the principal electric railway companies of the country. The gross earnings for 1905, and in many cases also for 1904, of 47 companies are given. The complete information can practically be applied to 1905, although the fiscal year of some of the companies ends on June 30th, for others, on September 30th, and still in some cases on December 1st.

Companies having gross receipts of over $1,000,000 include fifty-one companies, the aggregate being $227 946,916.

For companies having gross receipts of between $1,000,000 and $500,000, there are thirty nine, the amount being $27,507,576.

Companies having gross receipts between $500,000 and $100,000, number 170, and aggregate in amount $37,199,011.

Between $100,000 and $50,000, there are 100 companies whose gross receipts amount to $7,145,504.

Seventy-seven companies have gross receipts between $50,000 and $25,000 and total $2,800,225.

This gives an aggregate of $402,599,232 as the gross receipts of the 437 companies of which data is obtainable.

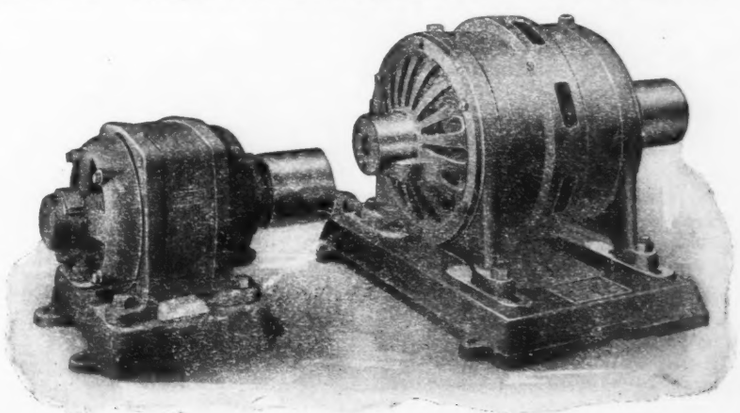


FIG. 3.

Industrial.

CENTURY-KLEIN ELECTRIC COMPANY.

We take pleasure in announcing the return to this city of the above firm, they having removed from their temporary office, 34 Telegraph avenue, Oakland, to their permanent home at 623 Sansome street, San Francisco. It is needless for the "The Jounral" to in any way attempt to introduce to the trade this well-known concern. We will state, however, that their facilities for handling their old business are far better than ever before. They have a complete stock of all lines of electrical goods and machinery on hand and are prepared to fill orders promptly. They are at present occupying over 25,000 square feet of floor space.

Mr. C. M. Wood and Mr. William L. Goodwin will give the management of the business their personal attention.

THE GENERAL ELECTRIC COMPANY.

To take care of the growing business about San Francisco the General Electric Company will shortly remove their Supply Department and Engineering Department from their temporary warehouse located in Emeryville, on the east side of the bay, to the modern warehouse built for them by the San Francisco Development Company on Fifteenth street between Kansas and Rhode Island avenues, San Francisco, where they will make their permanent headquarters The new building is one of three, four story brick, with stock brick trimmings, each 100 feet by 187½ feet, wood post girders and joist construction, and amply protected from fire by wire glass widows and equipped with sprinkler systems throughout. These buildings were designed by Meyers and Ward, architects, San Francisco, and cost $85,000 each, and are thoroughly modern in every respect. The first of these buildings was finished before the recent earthquake and fire and came out practically unharmed. The amount of floor space in the new warehouse (as shown in cut below) is 80,000 square feet, while it was originally intended to have about 40,000 square feet, but this was soon discovered to be entirely inadequate for even their immediate needs, as they will carry all their stock and do all their shipping from the new warehouse. In designing this building special care was given to provide ample facilities for quick unloading and speedy shipments by a railroad spur track where all cars can be delivered to their platforms Warehouses will be remarkably well lighted by widows on three sides, and in addition will have a skylight on the fourth floor. The present warehouse in Emeryville will be discontinued after they occupy their new quarters.

THE PELTON WATER WHEEL COMPANY.

The Pelton Water Wheel Company has practically completed its new works located at Nineteenth and Harrison streets, San Francsico, and will be in complete running order by September 1st. These shops were under construction before the fire, according to plans carefully prepared; consequently, they are entirely permanent—not designed under emergency conditions—and will afford the most modern facilities for handling and turning out high grade work.

Through their New York Works and temporary San Francisco works, the Pelton Water Wheel Company has been executing orders as usual, and has booked new orders which enable them to run at full capacity for many months to come.

The Pelton-Francis turbines recently placed on the market by this company has contributed its share to this season's work and is proving a valuable adjunct to the company's business. This is a new departure in water wheel practice, and is attracting the attention of engineers generally.

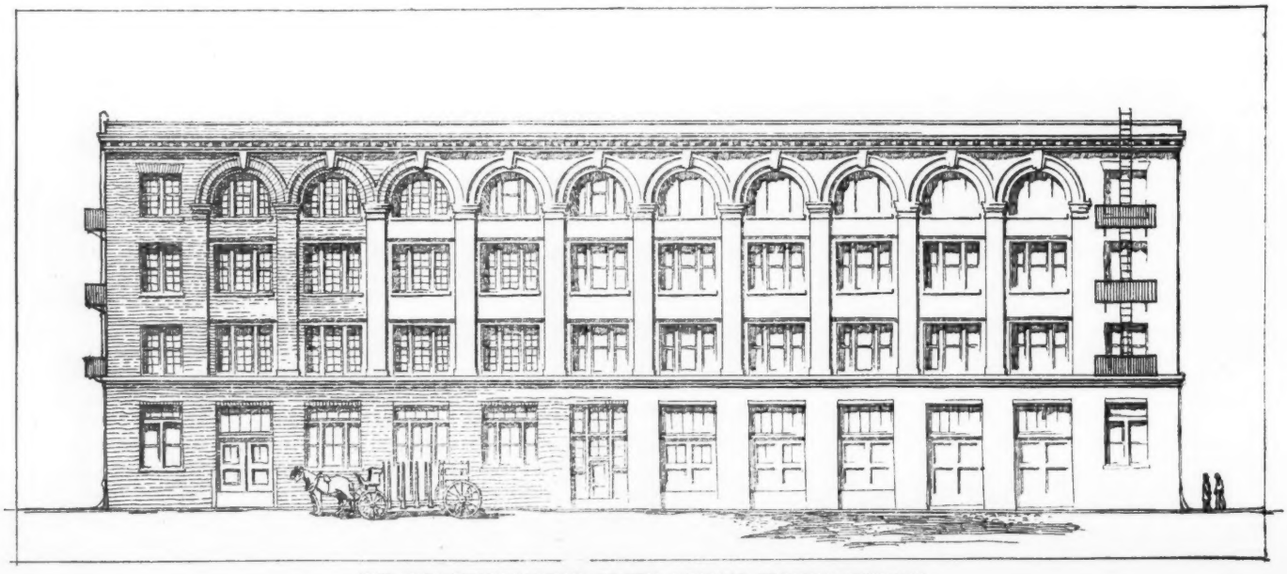
The Pelton Water Wheel Company is temporarily located at 517 Market street, San Francisco, but expects to be permanently located in the Monadnock Building, San Francisco, by August 15th.

ALLIS-CHALMERS TURBO-GENERATORS FOR NATIONAL CASH REGISTER COMPANY.

The National Cash Register Company, known everywhere for its progressive policy and whose works at Dayton, Ohio, have come to be looked upon as models of perfect works equipment and high efficiency, has purchased an addition to its present power plant in the shape of an Allis-Chalmers turbo-generator unit, which, it is expected, will be installed and in operation by December of this year.

The new unit is of the standard Allis-Chalmers design, the turbine having a rated capacity of 1000 kilowatts, while the generator, wound for sixty cycles, 250 volts, three phase, will have a normal capacity of 1500 K. V. A. The generator will be of the enclosed type, ventilated by means of air forced into the interior. By having a complete enclosed frame, the noise due to currents of air rushing through the frame openings will be reduced to a minimum. The turbine is designed to develop fifty per cent. overload when operating non-condensing.

Both the turbine and the alternator direct coupled to it, are the products of the Allis-Chalmers Company. The turbines are built at the West Allis, Milwaukee, shops, where extensive new facilities are being provided for their manufacture. The alternators will be built at the Company's electrical works, Cincinnati, Ohio.



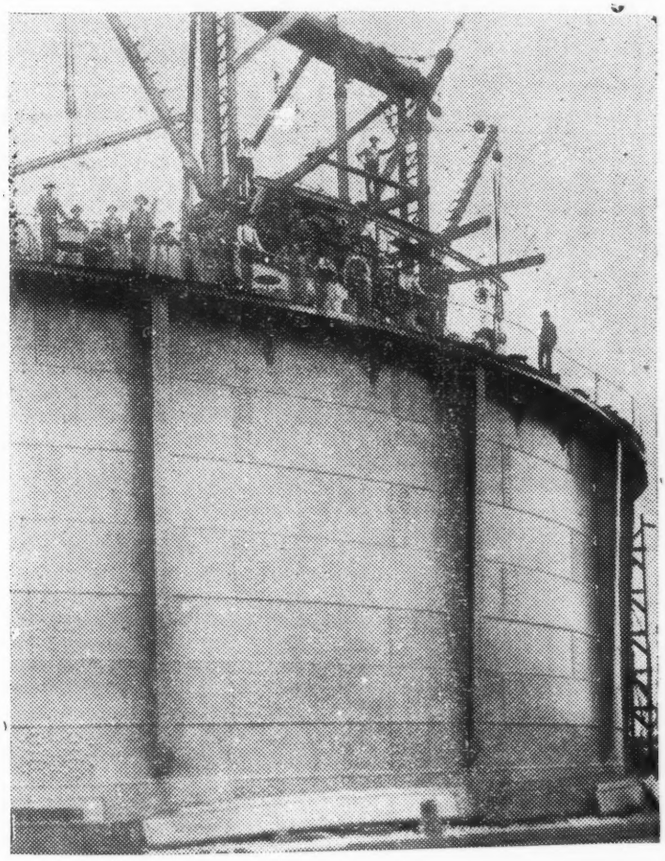
THE NEW HEADQUARTERS OF THE GENERAL ELECTRIC COMPANY.

THE LARGEST GAS TANK IN THE WEST.

Bigger and taller than the twelve-story Braly building, says the "Los Angeles Times," is the huge steel "gasholder" which the Los Angeles Gas and Electric Company is having erected on its property at the corner of Alameda and Seventh streets.

This huge structure, the upper section of which will rise and fall, telescoping from a height of 230 feet, will cost $300,000, and will hold 5,019,000 cubic feet of gas, while the capacity of the tank at the bottom, which filled with water prevents the escape of the imprisoned gas, is 8,563,200.

The diameter of the big gas holder is 195 feet. Its steel frame and the plates of which it is constructed weigh



6,000,000 pounds, and were brought to Los Angeles from the steel mills of Pennsylvania on 125 flat cars.

The Los Angeles Gas and Electric Company has other large gas holders, but this one will be five times as large as the largest now in commission, which is by no means a small one with its capacity of 1,000,000 cubic feet of gas.

The erection of this new receptacle for its lighting and heating product the gas company found necessary in the steady expansion of business, and the extension of its mains to the most remote districts of the city. The use of gas for heating in cooking is becoming so widespread in Los Angeles that it is doubtful if any other city of twice its population in the United States uses as many cubic feet for domestic purposes

From the generating plant at Aliso street and Central avenue, two twelve-inch mains lead down the Los Angeles River to the new gas holder, and from that point mains will branch out to feed the network of pipe lines with which the company has threaded the city streets.

A Philadelphia firm of steel contractors began work on the job January 1 of this year, under agreement to finish it by November 1, 1906, when the gas company must have it successfully to handle the prospective great increase in its winter business.

The structure is already high above ground, but has not yet reached its great height of 230 feet, which is fifty-seven feet higher than the Blary Building.

The tank is known as a five-lift holder and the sections of its huge steel bulk will rise and fall, steel plates telescoping within steel plates, with the ebb and flow of the gas drawn away through the mains and pumped in from the generating stations.

The separate sections will sink into a huge tank of water which will render the holder gas tight, preventing escape and leakage through the joints of the spearate sections.

ECONOMICAL METHODS IN THE MANUFACTURE OF STEEL.

Electric Power from Waste Gases.

There has been no more striking example of the methods of economy which have enabled the great steel companies of the country to lower the price of their product, and yet maintain themselves upon a high earning basis, than the adoption of gas engines using waste gas from the blast furnaces at high efficiency to produce compressed air for the operation of the furnaces and to generate electric current for transmission to the great mills which have grown up around them. These gases, at one time wasted entirely, have long been used under boilers to generate steam, but so inefficiently that enormous quantities of coal were required, in addition, in order to generate the power required. The enormous saving effected by this change is evident, but equally important are the advantages gained by the substitution of electric power, derived from one great centrally located power plant, for the multiplicity of prime movers characteristic of the old time installations.

There is not at the present time any gas engine in operation in this country that approaches in capacity the enormous engines which are now to be used, and the placing of orders by the steel corporation for engines of this size is considered by those in close touch with recent pro- gress of gas engine design and manufacture to be one of the most important innovations of modern industrial progress.

Two of the largest industrial organizations in the world, the United States Steel Corporation and Allis-Chalmers Company, have taken the initiative in bringing about this revolutionary change in methods of power production. The entire gas-engine driven electric generating equipment of these steel mills, except for two units placed as experimental orders with other builders, has been designed by the engineers of the Allis-Chalmers Company and is now under constructon in its shops.

Orders for gas electric generating units recently placed with Allis-Chalmers Company comprises 15,000 horsepower to be furnished for the Illinois Steel Company, 4000 horsepower for the Homestead plant of the Carnegie Steel Company and 35,000 horsepower for the Indiana Steel Company. Each unit is of 2000 kilowatt capacity. It consists of horizontal twin-tandem Allis-Chalmers gas engine, direct connected to an Allis-Chalmers generator. All of the generators, except two, are designed for alternating current, twenty-five cycle, three phase.

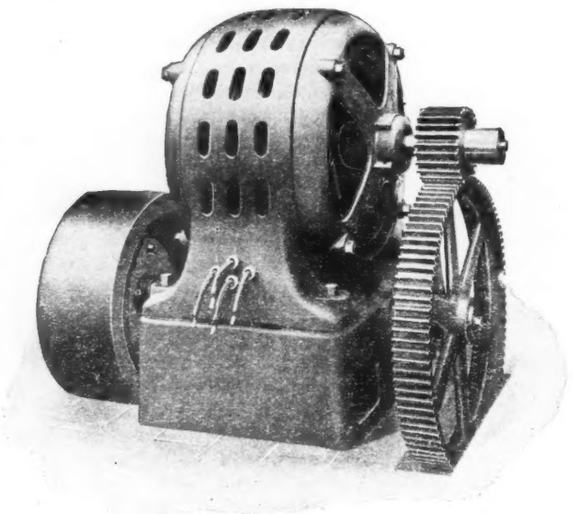
In addition to these electrical units the Allis-Chalmers Company is building equally large gas blowing engines for the United States Steel Corporation, four of which are to be installed in the Homestead plant. Of the remaining engines purchased for this purpose, which are to be constructed by other companies, all will be built under a license from Allis-Chalmers Company, owner of the Slick patents covering the blowing "tubs" adopted for these machines.

Each blowing engine has a capacity of 3500 horsepower and will deliver 30,000 cubic feet of free air per minute against a pressure of eighteen pounds per square inch which is ordinarily the maximum, but it is so designed and proportioned that it can be operated at any pressure up to thirty pounds.

Gas engines thus far purchased from Allis-Chalmers Company by the United States Steel Corporation will have an aggregate normal capacity of 68,000 horsepower and represent a value of over $2,000,000. Of this amount more than half is covered by one contract, making it the largest single order ever placed, in this country or abroad, for gas engines to be used either in blast furances for blowing purposes or as prime movers for electric generators.

POLYPHASE INDUCTION MOTORS.

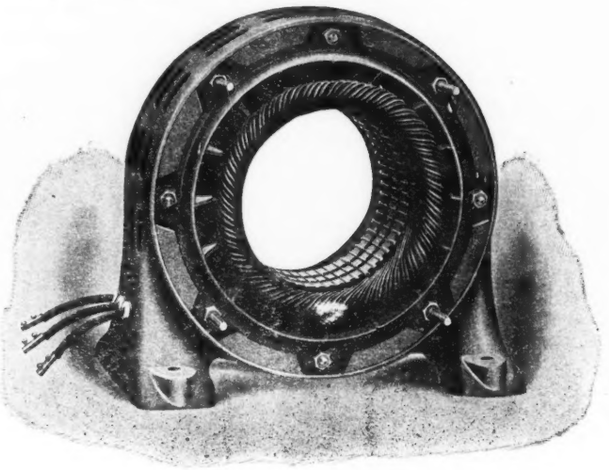
The accompanying illustrations, together with the performance curves, show what the Commercial Electric Company, of Indianapolis, is doing for users of polyphase induction motors. Before the expiration of the Tesla patents the elimination of competition removed the great stimulus for protection in design and in performance in this country, whereas in foreign countries where the freest and keenest competition has existed, the growth and perfection in induction apparatus was remarkable. The Commercial Company took advantage of these conditions and obtained the designs of its line of induction motors from the most experienced engineers and manufacturers of Europe, thus



giving them at once, complete in every detail, the design of a full line. The following claims of merit are made: High power factor, large nominal break down factor, high efficiency both at heavy and light load, low working temperature, small idle current, high starting torque, perfection of mechanical design and construction.

In producing an induction of high power factor it is necessary to have a limited clearance between the external diameter of the rotor and the internal diameter of the stator. The design of stator frame and stator head is such that an equal division of clearance is always secured and maintained, it being impossible to assemble the machine in such a manner as to give the rotor an unequal air gap on opposite sides.

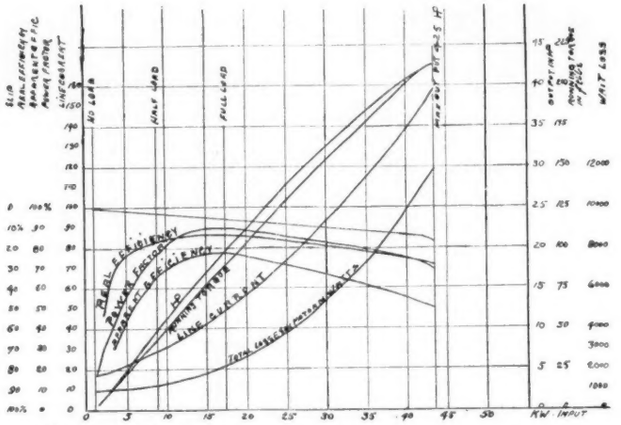
In order to reduce wear to a minimum, as well as to produce rigidity, very large shafts and bearing surfaces are given. The bearing linings are of phosphor bronze and are duplicate and interchangeable, so that the replacement of the bearing is more simple and less expensive than is the accurate readjustment of the so-called "adjustable" bearings with babbited linings. The ventilation of the machines is most perfect, as the illustrations show. Especial claim is made of the starting devices used in connection with these motors, which, if desired, will limit the starting current almost to that used on a direct current motor of corresponding size.



The slotting of the stator is a departure from the old American practice, and here lies an improvement which, although necessitating the use of the more expensive hand winding instead of machine made coils, render the machine much more perfect and has now been adopted by other American factories. The motor pulleys are the well known paper, unless otherwise ordered.

Shafts are of crucible steel, frames of semi-steel, all winding terminals brought out of flexible cables through porcelain bushings. The whole machine is the acme of simplicity, beautiful in design and finish.

The factory now announce that they are ready to deliver



immediately any sizes in twenty-five, fifty or sixty cycles from two to 200 horsepower, and are further prepared to manufacture larger or special machines on short notice, and that their Coast representatives, the Standard Electrical Works, have in stock both two and three phase, sixty cycle machines from two to fifty horsepower inclusive and in speeds from 850 to 1750.

A. E. Drendell, manager of the Drendell Switchboard Company, Seventeenth and Utah streets, has just returned from a trip east and reports the outlook for business very encouraging.

THE ABNER DOBLE COMPANY.

The Abner Doble Company, San Francisco, report very favorable prospects in the iron and steel line, and also in the manufacture of tangential water wheels. The company now have temporary machines and forge shops in operation on its block on Seventh and Hubbell streets, and is pushing the work on the new shops and warehouse. The buildings will be of steel frame and reinforced concrete construction and will be equipped with the latest types of machine tools and labor saving devices.

NEW LOCATON OF BYRON JACKSON MACHINE WORKS.

The Byron Jackson Machine Works, temporary office 18 Telegraph avenue, Oakland, Cal., have purchased twenty-eight acres on the water front and railroad in Berkeley, Cal., and are now erecting buildings on the site. Nearly all the machinery equipment for the plant has already been purchased and the company expect to be able to occupy the new plant early in August. The company manufacture a line of centrifugal pumps, high lift pumps, mining machinery and water wheels.

ELECTRIC TRAINS ON THE NEW YORK, NEW HAVEN AND HARTFORD.

It is now within the range of probability that the first single phase electric train will run on the New York, New Haven & Hartford Railroad between New York City and Stamford, Conn., before the summer is over. The latest reports from Coscob, where the electric power station is now being erected by Westinghouse, Church, Kerr & Co., who have charge of the construction of that building, are to the effect that everything is now about ready for the reception of the first installment of electrical machinery. Of the thirty-five locomotives, which will be operated on the road to begin with, the first are now undergoing practical tests on the Westinghouse Inter-Works Railway at East Pittsburg.

LARGE ORDER FOR CEMENT MACHINERY EQUIPMENT FOR THE PACIFIC COAST.

The efficiency and popularity of Allis-Chalmers crushers and cement grinding machinery has once more been demonstrated by the receipt from Dr. Irving A. Bachman acting for the Santa Cruz Portland Cement Company, and for the Atlantic Portland Cement Company, of the largest single order for cement machinery equipment ever placed by one man at one time in the history of the cement making industry of this country.

Allis-Chalmers machinery, which was furnished in 1901 to the Standard Portland Cement Company at Napa Junction, Cal., and which consisted of crushers, ball mills and tube mills, has been in continuous operation since then, giving such uniformly good satisfaction to Dr. Bachman that in October, 1905, he placed the initial order of the Santa Cruz Portland Cemert Company's equipment. There were included in it a No. 9 crusher, two No. 6 crushers, sixteen No. 8 Gates ball mills and twenty-two 5½ feet by 22 feet Gates tube mills.

Due to the increased demand for the cement products on the Pacific Coast, following the destruction of San Francisco, the Santa Cruz Company has now ordered an equipment which is practically a duplicate of the one already in service.

Salt Lake, Utah—The Salt Lake City district office of the Westinghouse Electric and Manufacturing Company was removed on July 2d, 1906, to 212-214 South West Temple street, Salt Lake City, Utah. The Dallas district office was also removed on the same date to 418 Main street, Dallas, Texas.

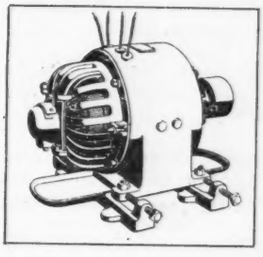
ALCOHOL ENGINES AS A SUBSTITUTE FOR GASOLINE.

There has been in some sections, says the "Gas Engine" we think, a feeling of expectation that, provided tax-free alcohol could be secured, alcohol engines would at once become more numerous than gasoline engines. In other instances there has been the feeling that all the talk about alcohol enignes was useless--mere talk—that under no circumstances would alcohol engines be able to exist under the conditions of the American fuel situation. As a matter of fact, the middle view is more likely to be the true one, as the measure providing for tax-free alcohol in this country becomes operative next January. We think we are safe in saying that the most zealous of the advocates of this measure did not anticipate an overwhelming and immediate introduction of the alcohol engines. One of the main reasons for the passage of the bill was to stimulate the production of engines which could operate on alcohol if the conditions should arise when it might prove desirable. Such a condition would exist if the supply of gasoline ran short, or if the price of gasoline should rise excessively or to a point where tax-free alcohol could compete with it. Of course this discussion is eliminating the question as affecting other interests.

However the bill had hardly passed the House before some very interesting experiments had been undertaken by numerous American manufacturers to ascertain how their engines would operate on the new fuel. No doubt such experiments as these will continue and we shall be surprised if the engines are not soon operating on this fuel in districts where gasoline or the common fuels is not avaialble.

Salem., Or.—Emery S. Dye has applied for a railway franchise in this city.

If



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News Notes.

Salem, Or.—The following incorporations have filed articles with the Secretary of State: Portland Railway Light and Power Company incorporators, J. F. Cahlin, E. B. Seabrook and C. A. Maney; principal office Portland; capital stock, $15,000,000, divided into 150,000 shares of $100 each.

Butte, Mont.—F. Aug. Heinze has applied for an electric light franchise.

Grangeville, Idaho—The Pacific States Telephone and Telegraph Company is making preparations to rush the work of reconstructing the local system. C. L. Wilson is the manager.

Helena, Mont.—The Rocky Mountain Bell Telephone Company has increased their capital stock from $600,000 to $10,000,000.

New Westminster, B. C.—The British Columbia Electrical Railway Company has decided to adopt Australian wood entirely for the construction of its cars in this city, and three cars now under way have been fitted with Australian lumber.

Port Townsend, Wash.—A private lighting plant is to be installed at the Northwestern Sanitarium. Archie D. Smith is the manager.

Echo, Or.—The City Council is now considering the installation of a municipal electric light plant.

Tacoma, Wash.—The Northwestern Long Distance Telephone Comapny has been granted a franchise by the County Commissioners to operate a long distance telephone line through all sections of Pierce county.

Vancouver, B. C.—The British Columbia Telephone Company is installing a new line between New Westminster and Ladner.

Spokane, Wash.—The Five Metals Mining Company is planning to erect a smelter near Kootenani Lake, J. P. Redding, manager

Butte, Mont.—The Inter-Mountain Construction Company has been incorporated by T. S. Lane and others to build telegraph and telephone lines; capital $100,000.

Spokane, Wash.—The Home Telephone Company will erect an exchange on Howard street between Railroad and Second avenues, to be of reinforced concrete and cost $60,000.

Springfield, Wash.—The Willamette Valley Company has applied for a franchise for an electric railway on Second street.

Portland, Or.—Work on the new interurban line to Linnton has been commenced by Lafe Pence, who secured a franchise some time ago.

Spokane, Wash.—The Spokane Pend d'Oreille Rapid Transit Company has filed application for a new street car franchise on Pacific avenue, Helena street, Second avenue and east to the city limits.

Great Falls, Mont.—The Montana Independent Telephone Company has been granted a franchise for a local system.

Alameda, Cal.—The Home Telephone Company of Alameda county have applied to the City Trustees for a franchise to construct a plant in the Island City. The matter was referred to the committee of the whole and will come up for consideration on July 13. The corporation promises to expend $75,000 within a year in Alameda, if the franchise is granted.

Seattle, Wash.—The Seattle Electric Company plans to have seven lines to carry passengers to the University grounds during the Alaska-Yukon-Pacific Exposition.

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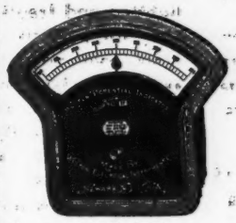

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Edward F. Cannon & Co., electric and hydraulic engineers, 309 McKay Bldg., Portland, Or.

Leon M. Hall, consulting engineer, 814 Hayward Building, San Francisco.

R. S. Masson, consulting engineer, 709 Pacific Electric Building, Los Angeles.

W. Stuart Smith, consulting engineer, 2538 Dwight Way, Berkeley, Cal.

H. C. Thaxter, electrical and mechanical engineer, Atlas Building, 604 Mission Street, San Francisco.

G. F. Wakefield, surveyor and engineer, room 22, Porter Bldg., San Jose, Cal.

Van der Nailen's School of Practical Engineering, Telegraph Ave. and 51st Street, Oakland.

Clem A. Copeland, M. E., consulting and supervising electrical and mechanical engineer, Bradbury Building, Los Angeles, Cal.

Robert McF. Doble, consulting and supervising engineer, San Francisco, Cal., Colorado Springs, Colo.

Mutual Gas and Engineering Company, consulting engineers and builders of gas plants, 202 Union Bank Building, Oakland.

Smith, Emery & Co., chemists and chemical engineers, 1104 Broadway, Oakland.

Rudolph W. Van Norden, consulting engineer, 105 Bacon Bldg., Oakland.

N. J. Neall, consulting electrical engineer (specialty lightning protective apparatus), 12 Pearl Street, Boston.

George H. Rowe, consulting electrical engineer. Specialty: Designing of alternating current apparatus and transmission systems. 1211 Fisher Building, Chicago.

ELECTRIC RAILWAY STATISTICS FOR GREAT BRITAIN.

Some interesting statistics regarding electric railways in the United Kingdom (Great Britain and Ireland) were published in the "London Electrician" recently. The following is a brief summary of the present situation: there are 114 tramways supplied with power from combined lighting and traction stations. There are forty-seven tramways having their own power-houses, and there are ten electric railways in operation and five more under construction. In addition to the above there are nine tramways and light railways now being built, the particulars of which are included in the figures which follow. The figures show that the tendency to supply electric railways and lighting systems from the same power-house is still in favor.

The 114 combined stations supply 1,190 miles of road, or 1,860 miles of single track. The forty-seven tramways having their own power-houses have a mileage of 780 which is equivalent to 1,180 miles of single track. The first group of tramways operate 5,060 cars and the latter 4,360. The following statistics show the condition of the electric railway situation in England on January 1, 1905, which are interesting for comparison: there were 1,770 miles of road, equivalent to 2,740 miles of single track. On January 1, 1906, there were 1,970 miles of road, equivalent to 3,040 miles of single track, an increase of abouteleven per cent. in each case. At the beginning of 1905 there were 106 miles of electrically equipped railroad, equivalent to 212 miles of track. At the beginning of the present year there were 150 miles of road, or 285 miles of single track, an increase of forty-one and thirty-four per cent. respectively.

Dallas, Or.—The Mutual Telephone Company and the Willamette Valley Electric Light Company are both repoling the town of Dallas. The new poles are of the latest size cedar poles and thirty feet above ground, in compliance with the city ordinances. The big power and light plant of the Willamette Valley Company is progressing rapidly. The foundation is terraced into the side of a butte on Dallas Heights in the South part of town. Fuel will be conveyed to it from the Cone mills by blow pipes and chain conveyors, a distance of 500 feet.

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